MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

VOL. XXIII. *March* 13, 1863. No. 5.

G. B. AIRY, Esq., Astronomer Royal, in the Chair.

On the Fringes of Light observed by M. Poulain at Goree during the Total Eclipse, 31st December, 1861. By M. Hermann Goldschmidt.

(*Extract from a Letter addressed to the Astronomer Royal.*)

I have seen in the *Monthly Notices* (which the Royal Astronomical Society kindly send me) the interesting drawing you laid before the Society, representing the fringes of light observed by M. Poulain at the total eclipse observed at Goree on the 31st Dec. 1861.

Allow me, Sir, to give you some details on the same object, concerning the conversation with the Spanish countryman who journeyed for some hours in our company in going from Vitoria to Bilbao. He stated that before the totality of the Eclipse of 1860, seen by him on a high mountain, yellow spots were seen flitting over their white clothes from West to East. He compared the colour with the most yellow flowers (like the *Ibericum*) we saw on the road. There is, indeed, no useful scientific information in this relation, but it confirms the direction of the movement observed by myself on the annular Eclipse of the year 1820, and mentioned by me in the descrip-

tion of the Solar Eclipse of the year 1860 (see *Astron. Nachrichten*, No. 1340, p. 308). It may be of some interest to give you the whole description of what I had seen in Frankfort-on-the-Maine on the afternoon of the 7th September, 1820.

I was in my uncle's house, one hundred and twenty paces only from my father's, when the darkness began. I left the house; but I had scarcely gone twenty paces in the street, from East to West exactly, when I saw the moving shadows coming towards me, covering the large and deserted street, and passing under my feet. Their movement was slow, for otherwise I could not have perceived them so distinctly, with the eyes so nearly fixed on them; the movement was not rapid. The aspect was like the shadow of smoke in sunshine—regular in translation; the forms, like rhomboids of four or six inches in diameter, and sometimes more extensive, were mixed with superposed shadows of the same size, and ribbon-like forms. The inner spaces particularly, filled with round spots softly melted and mixed with the whole in veiled grey transparence, gave to the phenomenon a somewhat mysterious appearance. Thus, looking to the paved street, these ribbons and spots flitted under my feet, till I arrived at a group of men near my father's house, after having made one hundred steps in contemplating this strange apparition. At this moment the annular eclipse was forming: the light of the Sun ran around the Moon in a very singular manner—it seemed like a fluid mass. I can truly estimate the time from the moment when I saw the shadows till the forming of the annulus—an interval of two minutes and thirty seconds.

I spread a large white cloth at my feet in Vitoria, but I had no time to look on it, absorbed by other business and the people who rushed in.

I had recommended this observation to Captain Manheim, who really saw the fringes at Constantine in the year 1860.

Paris, February 2nd, 1863.

On the Determination of the Longitude of Valencia, in Ireland, by Galvanic Signals, in the Summer of 1862. By G. B. Airy, Esq., Astronomer Royal. (Abstract.)

The Astronomer Royal adverts to the operation effected in 1844 for the determination of the longitude of the Feagh Main Station, in Valencia, by the transmission, ten times in both directions, of thirty pocket-chronometers, between Greenwich and Feagh Main; a transit instrument having been erected at Feagh Main, and the chronometers being compared with the transit-clocks at Greenwich and Feagh Main. Advantage was taken of the passage through Liverpool and

Kingston to determine the longitudes of the Liverpool Observatory and of a station near Kingston Harbour. The longitudes then found were

		m	s
Liverpool Observatory, West of Greenwich		12	0·05
Kingstown Station	,,	24	31·20
Feagh Main Station	,,	41	23·23

For details, he refers to *Mem. Roy. Ast. Soc.*, vol. xvi., or *Greenwich Observations*, 1845.

After the completion of galvanic communication between London and Valencia (consequent on the laying down of the Atlantic Telegraph), and the connexion, through the agency of the London District Telegraph and the British and Irish Magnetic Telegraph, between Greenwich and the London Offices of the B. and I. M. Telegraph Company, the Astronomer Royal, with the assured assistance of Sir Charles T. Bright and E. B. Bright, Esq. (Engineer and Managing Officer of that Company), and of T. B. Moseley, Esq., (their London Resident Officer), decided on repeating the determination by galvanic signals. The principal motive for this was, the desire of co-operating with M. Struve in establishing an Arc of Parallel from Valencia in the West to Orsk, on the river Oural, in the East. The station now adopted was not that of Feagh Main, but a place in Knightstown, in the vicinity of the Telegraph Office.

Sir Henry James and Captain Clarke, R.E., gave great assistance in the loan of observing hut, the conveyance of instruments, and other ways; and the Knight of Kerry and R. J. Leckie, Esq., contributed all the local aid that was required.

It was determined that local time at Valencia should be found entirely by observation of zenith distances, and a 12-inch Altazimuth (by Simms) was lent for this purpose by T. Coventry, Esq. The signals were simply movements of a galvanometer-needle at each station, the current being given at every 15^s nearly by an auxiliary clock.

The observers, Mr. Dunkin and Mr. Criswick, remained at Valencia from June 11 to July 23. During this time there were few opportunities of star-observation in consequence of the continued bad weather, and few opportunities of observing galvanic signals in consequence of interruptions at the Telegraph Office of Mallow. On the whole, only six nights of effective signals with good determinations of local time were obtained. The Valencia observer throughout was Mr. Dunkin, and the Greenwich observer of signals Mr. Ellis.

On reducing the altazimuth observations, great anomalies presented themselves in the determination both of latitude and of time. After carefully discussing the observations, and

making some experiments at Greenwich, it became clear that the zenith-distances were always given too great by about 4″. The cause of this anomaly is not known. On applying the corresponding correction, the results were made harmonious. It is remarked, however, that very little depended on this correction, the observations having been well balanced on the East and West sides of the meridian.

The signal-observations were then discussed nearly in the same way as in the determination of the longitude of Brussels (*Mem. Roy. Ast. Soc.*, vol. xxiv.), and the results were the following :—

	m	s
Time occupied in the passage of the current	0	0·129
Longitude of the Knightstown Station	41	9·81

By the kindness of Captain Clarke a geodetic connexion was made between the Feagh Main Station and the Knightstown Station, and their geodetic difference of longitude was found to be $13^{s}\cdot56$. Applying this to the former determination for Feagh Main, it is found that the old operations would have given for Knightstown $41^{m}\ 9^{s}\cdot67$. The agreement of this with that found from the galvanic operation is very remarkable, and it proves that implicit confidence may be placed in the old determinations for Liverpool and Knightstown.

On the Movement of the Solar System in Space, deduced from the Proper Motions of 1167 *Stars.* By Edwin Dunkin, Esq., of the Royal Observatory, Greenwich.—(Abstract.)

The investigation which forms the subject of this Memoir, may be considered as a supplement or addendum to that of the Astronomer Royal, *On the Movement of the Solar System in Space*, published in vol. xxviii. of the Society's *Memoirs*. The method of calculation differs in no respect from that previously used, excepting that the Proper Motions of a much greater number of stars have been combined in producing the results. It is intended, therefore, that this paper should be read in connexion with the memoir of Mr. Airy, as the mathematical explanation, which has been given in detail by him, is not generally repeated on this occasion.

In this memoir, the Proper Motions of nearly all the stars contained in the Catalogues of the Rev. R. Main, have been adopted, numbering in all 1167 stars. In Right Ascension they are scattered in nearly equal proportions over the twenty-four

hours, and in Declination, about two-thirds are situated in the northern hemisphere. The stars are arranged into groups or divisions, according to magnitude, in conformity with the researches of W. Struve, whose value of r has been adopted. The number of stars included in each division, and Struve's value of r, are as follows:—

Division.	Magnitude.	Value of r.	Number of stars in each Division.
1	1	1·00	9
2	1,2 2 2,3	1·71	55
3	3,2 3 3,4	2·57	146
4	4,3 4 4,5	3·76	238
5	5,4 5 5,6	5·44	330
6	6,5 6 6,7	7·86	368
7	7,6 7 7,8 8	11·34	21

The method which the Astronomer Royal has proposed for determining the direction of solar motion, as being entirely free from the objections attaching to those of former investigations, "and, indeed, unobjectionable on the score of accuracy, consists merely in removing the primary geometrical notions from the apparent movements of the bodies in space. It is the obvious and simple method of treating the linear movements of the Sun, and of each star, by the use of rectangular co-ordinates. This method is in itself absolutely independent and complete, and requires no assumption of a point determined by preceding investigation."

For convenience of reference, the final symbolical equations from which the different numerical equations are immediately derived on two extreme suppositions, are inserted in the memoir. For the first supposition, it is assumed that the irregularities of Proper Motion are due to chance-error of observation; while in the second supposition they are considered to be entirely due to a peculiar motion of the stars.

The numerical equations for X, Y, Z, have been formed for each division on both suppositions, $-X$ representing the annual linear motion of the Sun in the direction of the first point of *Aries*, $-Y$ the motion in the plane of the equator towards that point whose right ascension is ninety degrees, and $-Z$ the motion towards the north pole of the equator. The solution of the sums of these equations gives the following values, neglecting very small terms depending on n' and q.

On the first supposition:

$$X = +0{\cdot}0428 + 1{\cdot}2349 \times n'$$
$$Y = +0{\cdot}2776$$
$$Z = -0{\cdot}1818 + 3{\cdot}5792 \times q$$

On the second supposition:

$$X = +0\cdot0406 + 2\cdot3747 \times n'$$
$$Y = +0\cdot3696$$
$$Z = -0\cdot1735 + 6\cdot1090 \times q.$$

From the above the following expressions are deduced:—

On the first supposition:

$$R = 0\cdot3346 \quad + 0\cdot1580 \times n' - 1\cdot945 \times q$$
$$A = 261^\circ\ 14'\ 0 - 4\cdot3454 \times n'$$
$$= 261\ 14\ 0 - 248^\circ\cdot97 \times n'$$
$$D = +32\ 55\ 0 - 0\cdot3057 \times n' - 8\cdot9811 \times q$$
$$= +32\ 55\ 0 - 17^\circ\cdot52 \times n' - 524^\circ\cdot54 \times q$$

On the second supposition:

$$R = 0\cdot4103 \quad + 0\cdot2350 \times n' - 2\cdot5826 \times q$$
$$A = 263^\circ\ 43'\ 9 - 6\cdot3480 \times n'$$
$$= 263\ 43\ 9 - 363^\circ\cdot71 \times n'$$
$$D = +25\ 0\ 5 - 0\cdot2672 \times n' - 13\cdot4937 \times q$$
$$= +25\ 0\ 5 - 15^\circ\cdot31' \times n' - 773^\circ\cdot13 \times q.$$

The preceding results have all been reduced, on the assumption that the distance of the stars varies inversely to their magnitude, regardless of the amount of Proper Motion. It is by no means improbable, however, that the few stars of the fourth, fifth, and sixth magnitudes, whose Proper Motions are extravagantly large, are really near stars, and as such might be placed with propriety in the first division. The results of a transfer of this kind, in addition to others of a similar nature, are given in the memoir. A glance at the values of X, Y, Z, determined by these different assumptions, shows distinctly that they are not relatively improved by any deviation from Struve's law of the mean distances of the different groups of stars with respect to these exceptional stars.

The value of R, or the Sun's proper motion as viewed from a star of the first magnitude, expressed in seconds, resulting from this investigation, differs very slightly from that determined by M. Otto Struve. His value is 0·3392. There is very little doubt, therefore, that a value near the mean of these numbers may be assumed as fairly representing the annual motion of the Sun and solar system towards the point to which the direction is assigned, so far as any result can be obtained by the use of the known apparent proper motions of the stars.

To show the numerical evidence of the probability that the values previously given should in some measure represent the motion of the solar system, the sums of the squares of the observed Proper Motions in Parallel and North Polar Distance

were formed, and these have been compared with the squares of the residual errors after the corrections depending on solar motion have been applied. This comparison was only made on the second supposition. The results are exhibited in the memoir for each division; the total sums of the squares are as follows:—

Sum of squares of Motion in Parallel { Uncorrected = 78·7583
Corrected = 75·5831

Sum of squares of Motion in N.P.D. { Uncorrected = 63·2668
Corrected = 60·9084

"The reader must draw his own conclusions on the comparison of the uncorrected and corrected results given above. It appears to me that our fundamental suppositions rest altogether on a very slender basis; and the results warrant the question whether we have much ground to infer that the Proper Motions of the stars are produced principally by the motion of the Sun and its system in space. It may be, and probably such an inference is partially true, that these apparent motions in the positions of the stars are due to some compound effect resulting from causes some of which have yet to be discovered; though it is very remarkable that different astronomers, with totally different methods of investigation, should, without exception, fix the point in the heavens to which the solar motion is directed, within a few degrees of each other."

The memoir concludes with a comparison of the position of this point as determined by different astronomers, from the date of Sir William Herschel's original paper in 1783, to the present time. The author remarks on the extraordinary agreement of these researches:—"To say the least, this confirmation of result after result, would seem to show that the Proper Motions of the stars *must* be connected with the motion of the Sun in the direction of the point in the heavens indicated above. But the further consideration of this I must leave for others, merely remarking, that the grounds upon which we have been working are uncertain to a considerable extent, which uncertainty will scarcely be removed until our knowledge of the distances of the stars is increased, or until the Proper Motions themselves are re-determined from unexceptionable observations, made at both epochs, with the improved instruments of modern Observatories."

A table is appended to the memoir, containing the principal elements from which the numerical co-efficients have been computed. The stars are arranged in their respective divisions, in order of Right Ascension, excepting that all stars of North Declination are grouped together, the same being also done for stars of South Declination.

On the Rating of Chronometers. By J. Hartnup, Esq.

At the Liverpool Observatory, Mr. Hartnup has been recently engaged in discussing the sea-rates of nearly two thousand chronometers, for the purpose of ascertaining the average errors for voyages of different lengths. On comparing the rates at sea with the rates of the same chronometers obtained at the Observatory, the importance of attending to the thermal correction has manifested itself more strongly than ever; and, in addition to this, the rates are often found to increase or diminish with such regularity from one month to another, that a correction for this may also be very frequently applied with great advantage. Mr. Hartnup has, therefore, been induced to make considerable alterations in his method of testing and giving the rates of chronometers, with the view of ascertaining the value of these corrections more accurately, and of rendering the application of them more simple.

The following is an example:—

From the week ending November 1, 1862, to the week ending January 24, 1863, the temperatures to which the chronometer was exposed were 55°, 70°, 85°, 70°, 55°, and so on in succession; it, therefore, requires five weeks for a complete series of rates in the above-named temperatures, and these were obtained between October 25 and November 29, the observed rates being as follows:—

	Temp.	Rate.
	°	s
Nov. 1	55	+0·9
8	70	+0·4
15	85	−0·7
22	70	+1·6
29	55	+2·1

Now the rates in 55° for the week ending November 1 being 0s·9 gaining, and in the same temperature for the week ending November 29 being 2s·1 gaining, the difference is 1s·2, which, divided by 4, the number of intervening weeks, gives 0s·3 for the weekly increase of gaining rate.

We, therefore, have for November 15:—

	Mean daily rate	losing	s 0·7 in 85 °
From Nov. 8 and 22	,,	gaining	1·0 in 70
From Nov. 1 and 29	,,	gaining	1·5 in 55

And weekly acceleration of gaining rate 0·3

With the above data the error on Greenwich Mean Time has been calculated for each week subsequent to November 15, by adding 0s·3 × by the number of weeks to that mean daily

rate which corresponds with the temperature to which the chronometer was exposed, multiplying the sum by 7, and adding the amount thus obtained to the error for the preceding week. That is, Calculated Daily Rate = Daily Rate Nov. 15 for same temperature + $0^s{\cdot}3$ × number of weeks since Nov. 15. For example, for the week ending Jan. 17, temperature 70°, Calculated Daily Rate = $1^s{\cdot}0 + 9 \times 0^s{\cdot}3 = 3^s{\cdot}7$, which, multiplied by 7, is = $25^s{\cdot}9$, and Calculated Error for Jan. 17 = Calculated Error for Jan. 10 + $25^s{\cdot}9 = 0^h\,3^m\,58^s{\cdot}1 + 25^s{\cdot}9 = 0^h\,4^m\,24^s{\cdot}1$.

In this way the following Calculated Errors in Greenwich Mean Time have been obtained, and compared with those found by observation, from November 22, 1862, to January 24, 1863, and the Observed — Calculated Errors range from + $3^s{\cdot}8$ to — $8^s{\cdot}5$ for the eight weeks subsequent to the last observed error and rate used in the calculation.

1862.	Temperature to which Chronometer was exposed.	Error on G.M.T. Calculated.	Observed.	Obsⁿ — Calⁿ.
		h m s	h m s	s
Nov. 22	70	0 2 12·4	0 2 14·5	+2·1
29	55	2 27·1	2 29·4	+2·4
Dec. 6	70	2 40·4	2 42·6	+2·2
13	85	2 43·9	2 47·6	+3·7
20	70	3 1·4	3 5·2	+3·8
27	55	3 24·5	3 27·1	+2·6
1863.				
Jan. 3	70	3 46·2	3 47·5	+1·3
10	85	3 58·1	3 57·6	−0·5
17	70	4 24·0	4 18·9	−5·1
24	55	0 4 55·5	0 4 47·0	−8·5

If the corrections for temperature and acceleration of rate had not been applied and the $0^s{\cdot}7$ losing rate found for the week ending November 15 had been used, then, by exposing the chronometer to a temperature of 55° for the eight weeks, the Greenwich Mean Time by the chronometer would have been wrong nearly four minutes; and if, on the other hand, the rate for 55° had been used and the chronometer exposed for the eight weeks to 85°, the error would have been only a few seconds. In the former case the defective thermal compensation and acceleration of rate both tend to increase the error, while in the latter they nearly neutralise each other. It is, therefore, not surprising that we frequently hear of so much difference being found between the sea and land rates of chronometers; nor can it be expected but that we meet with very discordant results in attempting to find the average error to which chronometers are liable at sea. The average error for a voyage of eight weeks, found from data given at foreign ports, is a little under one minute; but while the

Greenwich Time shown by ten per cent of the chronometers from which this result is obtained, is found to be nearly free from error, there are also ten per cent in which the average error is upwards of four minutes.

On the Parallax of certain Stars. By M. Auwers.

(*Extract of a Letter to the Astronomer Royal, dated Gotha*, 1863, *Jan.* 16.)

Since I communicated to you the notices on the Parallaxes of two stars, I have made an examination of Johnson's observations of 61 *Cygni*, in the hope that the Oxford heliometer, if the observations made by it are treated in such a manner as to make the known systematic faults of heliometer-distances exercise the least possible influence on the results sought, may give a decisive voice for one of the two irreconcileable values for the Parallax, namely Bessel's of 0″·370, and Struve's and mine of 0″·553.

I have taken as the subject of calculation the quantity 0″·705 × dist. of 61 *Cygni* from B.A.C. 7320 — dist. of 61 *Cygni* from Lalande 41030, instead of the distances themselves, or their immediate differences; my hopes, however, have not been confirmed.

The whole series of observations gave the Parallax = 0″·426; the residual errors, however, are of such a nature that we cannot look upon the observations as sufficiently represented with this value of Parallax. Still less is this the case, if, instead of using the annual variation of the above-given differences that follows from the measures themselves, we assume that which follows with greater security from the meridian observations, with which the Parallax comes out 0″·402. But if we calculate separately the observations of the eleven first months (40 in number), and those of the remaining seven months, we obtain from the former the Parallax = 0″·526, from the latter only = 0″·192; the first of these values agrees very well with Struve's and mine, whilst the second departs materially from all determinations, and seems to show that the observations made after June 1853 are affected with some systematic error.

On the Parallax of the Fixed Stars. By M. Krüger.

(*Lettre de M. Krüger à M. Le Verrier.*)

The following letter appears in the *Bulletin Météorologique*, 1863, Feb. 9th.

"Permettez moi de vous communiquer le résultat de deux séries d'observations faites à l'aide de l'excellent héliomètre de Bonn sur des parallaxes d'étoiles fixes. La première se rapporte à l'étoile Lalande 21258, $8{\cdot}9^{eme}$ grandeur, dont le grand mouvement propre a été signalé par M. Argelander dans le No. 1288 des *Astronomische Nachrichten*. J'ai trouvé par 36 comparaisons avec deux étoiles, dont l'une précède, l'autre suit, à peu près sur le parallèle :—

"Parallax annuelle de J. Lalande 21258 $= +0''{\cdot}260$ avec l'erreur probable $\pm 0''{\cdot}02$.

"La seconde recherche concerne l'étoile de 9^{eme} grandeur, 17415–6 dans le Catalogue de M. Oeltzen, pour laquelle M. Argelander a trouvé un mouvement annuel de 1·2 secondes. Au moyen de 45 comparaisons avec deux étoiles convenablement situées, le résultat suivant a été évalué :—

"Parallax annuelle de Oeltzen 17415–6 $= +0''{\cdot}247$, avec l'erreur probable $\pm 0''{\cdot}021$.

"*Helsingfors*, 1863, *Janvier* 31."

Results of the Meridional Observations of Small Planets; Occultation of a Star by the Moon; and Phenomena of Jupiter's Satellites; observed at the Royal Observatory, Greenwich, in the month of January, 1863.

(*Communicated by the Astronomer Royal.*)

Victoria (12).

Mean Solar Time of Observation.		R.A. from Observation.	N.P.D. from Observation.
	h m s	h m s	° ′ ″
1863, Jan. 24	13 15 13·8	9 30 39·00	88 23 52·01
27	13 0 43·6	9 27 56·07	88 17 0·01

Bellona (28).

Mean Solar Time of Observation.		R.A. from Observation.	N.P.D. from Observation.
	h m s	h m s	° ′ ″
1863, Jan. 24	13 16 13·9	9 31 39·32	78 17 31·21
27	13 2 17·9	9 29 30·68	77 53 19·56

Urania (30).

Mean Solar Time of Observation.		R.A. from Observation.	N.P.D. from Observation.
	h m s	h m s	° ′ ″
1863, Jan. 19	9 16 14·6	5 11 17·83	65 10 55·38
20	9 12 1·8	5 11 0·86	65 12 47·74
23	8 59 40·0	5 10 26·74	65 18 13·61
24	8 55 37·0	5 10 19·58	65 19 55·63
27	8 43 40·9	5 10 11·21	65 24 41·73

Ariadne (48).

Mean Solar Time of Observation.		R.A. from Observation.	N.P.D. from Observation.
	h m s	h m s	° ′ ″
1863, Jan. 24	12 33 49·8	8 49 8·19	76 17 52·45
27	12 18 41·8	8 45 47·45	76 7 59·58

Europa (52).

Mean Solar Time of Observation.		R.A. from Observation.	N.P.D. from Observation.
	h m s	h m s	° ′ ″
1863, Jan. 7	12 11 25·0	7 19 38·26	72 5 2·33
20	11 9 18·9	7 8 37·25	71 10 13·91
23	10 55 11·3	7 6 16·94	70 57 32·27
24	10 50 30·5	7 5 31·95	70 53 26·28
27	10 36 33·7	7 3 22·58	70 40 57·38
29	10 27 21·3	7 2 1·71	70 32 47·00

All the observations of N.P.D. have been corrected for refraction and parallax.

Occultation of a Star by the Moon.

Day of Obs.	Phenomenon.	Moon's Limb.	Mean Solar Time.	Observer.
			h m s	
1863, Jan. 27	Disappearance	Dark	5 9 49·1	D.
27	Reappearance	Bright	6 28 30·6	D.

Phenomena of Jupiter's Satellites.

Day of Observation.	Satellite.	Phenomenon.	Mean Solar Time.	Observer.
1863.			h m s	
Jan. 24	I.	Eclipse disapp.	13 53 45·8	C.
27	II.	Eclipse disapp.	13 8 34·9	D.

The initials D. and C. are respectively those of Mr. Dunkin and Mr. Criswick.

Occultations observed at Highbury. By T. W. Burr, Esq.

1863, Feb. 27th, 15 *Geminorum* disappeared at $8^h\ 13^m\ 21^s{\cdot}4$, Local Sidereal Time. March 2d, α *Cancri* disappeared at $10^h\ 28^m\ 34^s{\cdot}5$, Local Sidereal Time.

Both occultations were by the Moon's dark limb. The star 15 *Geminorum* was very faint, and in no case could the emersion be accurately observed. Telescope as usual, my 4 ft. 4 in. Equatoreal, $3\frac{3}{8}$ inch aperture. Power 173. Longitude, 24^s W.

Highbury, March 12th, 1863.

On the Visibility of Stars in the Pleiades to the unarmed Eye. By G. B. Airy, Esq., Astronomer Royal.

To the greater number of star-gazers, with what are commonly considered "good eyes," I believe that Ovid's remark as to the visible number of *Pleiades* still applies:—

"Quæ septem dici, sex tamen esse solent."

I find, however, that one of the members of my family habitually sees seven stars, and, on rarer occasions, twelve. On the clear evening of 1863, Feb. 15th, a map of the visible stars was drawn from ocular view, and, on comparing it with

North.

a map drawn from Bessel's measures, I had no difficulty in identifying the stars as those which Bessel has marked by the following numbers:—

No. 1	No. 17 (bright)
2 (bright)	29
4	34 (brightest = *n Tauri*)
4 (bright)	38
11 (bright)	41 (bright)
13	42 (not quite so bright)

No. 42 is the seventh star, which is seen only by acute eyes.

Observations of Mars. By W. Lassell, Esq.

I have the pleasure to present to the Society herewith a series of drawings of the planet *Mars* during the late favourable opposition.*

The more deeply-shaded parts of the series are generally the blue and neutral-tint portions — the lighter shades represent the ruddy or deep-orange parts — and the unshaded parts, the brightest portions, which are generally about the circumference. The faint lines exterior to the disk represent approximately the position of the ecliptic with respect to the phenomena of its surface. The times given are Greenwich Mean Time.

The drawings are *tracings* of the original drawings made at the telescope's side. Towards the North Pole there was generally a bright part, less marked, however, than the conspicuous spot at the South Pole. This is most striking, as might be expected, in those phases in which the neighbouring portion is most shaded. On the 22d Sept. (No. 3 drawing) a bright marginal crescent, on the following side, extended nearly over half the circumference. No. 4 (24th Sept.) was drawn from a very sharp image and with great care. On the 25th Oct. (No. 15) the long band of white near the North Pole was remarkably plain. The phenomena were best seen with a Power 760. On the 27th Oct. (No. 16) the planet exhibited with 760 a very fine view of delicate markings, very difficult to draw. There seemed to be a protuberance of the limb about (*c*), where also the limb was whiter than at the parts adjacent. A long white tract was visible at (*b*) only a little inferior to the brightness of the white spot at (*d*). There was a blueish-white district at (*a*). The dark or neutral-tint portion seemed shaded off there into a lighter hue of the same

* These drawings will probably appear in lithograph in the volume o *Memoirs*.— Ed.

colour—not at all into the coppery tinge. The ruddy portion was much more uniform, as indeed it generally is, than the blue or green portion. The only distinct mark I saw upon it was a curved streak near the South Pole, which appeared to be a very slight shade of the blue colour. Several of these remarks apply generally to most of the drawings; but I make them here because the view obtained this evening was one of the very finest I have ever had. Nov. 4th (No. 17), power 760, the planet has already become obviously gibbous. The blue portion has in its darkest part a very irregular and hard outline, which is strikingly analogous to the coast-line of a terrestrial continent, much broken by bays and inlets. I find it impossible to represent its outline faithfully. There are also delicate markings on the red or brown portion near the bright spot, which baffle my skill. The view with this high power is at times surprisingly sharp.

In watching *Mars* for so long a period I expected to have been able to observe returns of the same phase according to the law of rotation, but I have not found it possible to do so except very imperfectly. To watch the progress of any individual spot during a few hours observation on any one evening, or after the interval of one day or two, is easy enough; but when the same phases ought again to occur after an interval of time, I find they can rarely be certainly recognised.

For instance, the phase given

Sept. 13,	ought nearly to recur	Oct.	22
,, 20	,,	,,	,, 29
,, 22	,,	,,	,, 31
,, 24	,,	,,	Nov. 2
,, 25	,,	,,	,, 3
,, 27	,,	,,	,, 5
,, 29	,,	,,	,, 7
Oct. 11	,,	,,	,, 19
,, 13	,,	,,	,, 21
,, 15	,,	,,	,, 23
,, 17	,,	,,	,, 25
,, 18	,,	,,	,, 26
,, 21	,,	,,	,, 29

but if the drawings nearest these dates are severally compared, the resemblance is certainly traceable in most instances, but not with that uniformity which would indicate an unchanged surface. I therefore think, as has been justly remarked by Mr. Grove in the *Monthly Notice* for December, that if the variously coloured portions do generally represent land and water, their aspect must be greatly modified by the transit of clouds of great extent, density, and variety of form.

It will be seen that there is much less detail in the later drawings, which are scarcely comparable with the early ones on account of the greatly increased distance of the planet.

Proceedings of the Madras Observatory. By Norman Pogson, Esq., Director of the Observatory.

The following Memorandum, relating to the current and the proposed work of the Madras Observatory, has been transmitted by Mr. Pogson to the Astronomer Royal:

"The proceedings of the Madras Observatory during the past two years, although not yet before the public, nor indeed likely to be so at present, may not be without sufficient interest to warrant a brief recapitulation. The new Transit Circle was finally completed and commenced its career of service on the 1st June, 1862. It yields the most satisfactory results as regards steadiness in all its corrections, and is being employed for the determination of the positions of comparison stars used for equatoreal observations, of all observable variable stars, of such small planets as come to opposition south of the equator, and generally for the formation of a Catalogue of new small southern stars as zero points for the Southern Celestial Survey, now in hand. This latter work, announced in the *Monthly Notice* of last June, was commenced on the first night of this year, and will be proceeded with rapidly, aided, it is hoped, by an experienced assistant whom it is intended to request Prof. Argelander to nominate, so soon as the sanction already granted by the local government has been confirmed by the supreme authorities.

"The Variable-Star-Atlas is just beginning to be engraved, and as from its nature it can only be proceeded with on perfectly clear moonless nights, must necessarily be some time in hand—interfering certainly to some extent with the Southern Survey, but not being in any way delayed by the contemporaneous execution of that far higher and more comprehensive work now fairly in hand. A useful Catalogue of Stars observed under the management of Lieut.-Col. Worster, when acting Astronomer, is in an advanced state of reduction. Observations of the fine comets of 1858, 1861, and 1862, and of several small planets, await the determination of the comparison stars employed by the Transit Circle, all which will, it is hoped, be secured in the ensuing fine season.

"The Magnetical and Meteorological records, carried on hourly for the twenty years 1831–1860, are wearily advancing as regards reduction and publication. The former are printed up to 1854, the latter a year further on. These heavy arrears

form the most trying portion of the observatory duties, and most grievously interfere with the astronomical department at the present time. Twenty districts, each averaging about seven talugs, are now made to send rain returns to the Observatory, and the arrangement of these, more especially the sifting and summing up of the registers of eight years past, will be no trifling additional task.

"The planet *Mars* was duly observed as proposed when in opposition, for the investigation of the Solar Parallax, both with the Equatoreal at rising and setting, and with the Transit Circle at meridian passage; but owing to pressure of other immediate duties, the observations have not yet been sufficiently reduced for submission to their respective head-quarters, viz., Greenwich and Pulkova.

"Some highly desirable longitude determinations are under contemplation throughout India, at no distant period, by means of the electric telegraph, and as a first step thereto, the construction of a chronograph has been sanctioned by the Local Government. A new Equatoreal of larger aperture and a superior Anemometer are expected to be supplied shortly. The present instruments are all in fair order, having been cleaned up and repaired by Mr. F. Doderet, the mathematical instrument maker to the Public Works Department, from which his services were transferred to the Observatory throughout the first half of the past year."

Madras, 1863, *Jan.* 26.

At a recent meeting of the Royal Society, our Fellow, Mr. Huggins, in conjunction with Dr. W. A. Miller, the Treasurer of that Society, communicated a Note on the "Lines in the Spectra of some of the Fixed Stars," as an earnest of the results of twelve months' observations of some 30 or 40 stars, the Moon, *Jupiter*, and *Mars*, which are to follow.

The valuable observations of Dr. Miller on the photographic spectra of the metals, &c., are too well known to require mention here, did not a recent deduction from them hold out great promise of doing for the *temperature* of the Sun and stars what the magnificent generalisation of Kirchoff has done for their *chemical constitution*. It has been shown that the spectra of metals vary with the temperature of the source of light, the higher the temperature the more refrangible being the vibrations. Thus, by introducing lime and sulphate of magnesia into the oxyhydrogen jet, the flame of which, according to Bunsen, cannot exceed 14580° Fahr., a spectrum has been obtained corresponding in length with that of the Sun; by employing the

electric spark between magnesium terminals, however, a very decided band is obtained beyond the limits of the solar spectrum. Now, as magnesium is well known to exist in the Sun, it would thus appear that the temperature of that luminary is not so high as that of the electric spark, and that approximately it is not higher than that of the oxyhydrogen flame.

Next in importance to a form of apparatus which enables the lines to be clearly seen, must be reckoned the arrangement by which they are measured and referred to Fraunhofer's lines, the universally accepted standard of comparison. Mr. Huggins, having proved the exact coincidence of the sodium band with the solar line D on his apparatus (which is attached to his equatoreally-mounted 8-inch refractor), has employed it as the point from which all measures are taken, the sodium band being compared directly with the stellar spectrum under observation, both being in the field of view of the telescope. To guard against every source of error, however, in such delicate investigations, the spectra of one or two of the metals have also been compared with the stellar spectrum in some cases; and it is the intention of the authors of the Note to supplement their observations with these additional direct comparisons in each instance.

It may be mentioned that since this valuable communication was made to the Royal Society, Dr. Miller and Mr. Huggins have succeeded in obtaining microscopic photographs of the spectra of *Sirius* and *Capella*. Diagrams of the lines in *Sirius*, *α Orionis*, and *Aldebaran*, which had been observed and measured with great accuracy, accompanied the paper.

J. N. L.

An account, by Prof. Secchi, of his latest observations on the same subject, together with a sketch of the Spectra of *α Orionis*, *Aldebaran*, *Sirius*, *Rigel*, and *Pollux*, will be found, *Ast. Nach.*, No. 1405.—Ed.

A communication has been received from M. de Gasparis, "*Sur une Equation pour le Calcul des Orbites Planetaires.*" This has already been published in the *Ast. Nach.*, No. 1405, and in the *Comptes Rendus* of the Academy of Paris.

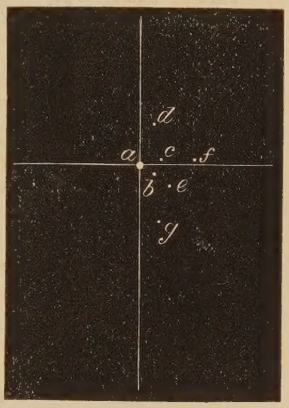
---

*Companions of Sirius.**

M. Goldschmidt has announced to the Academy of Sciences at Paris the discovery of several stars in the neighbourhood of *Sirius*:—

"The unexpected discovery of a companion of *Sirius*, by Mr. Clark, confirms in a striking manner the existence of a celestial body in the neighbourhood of *Sirius*, theoretically predicted by Bessel, Peters, Auwers, and Safford. The companion perceived by Mr. Clark—is it illumined by *Sirius*, or a Sun shining by its own proper light? In the latter case, we should have two stars physically combined, forming a system of double stars. Having tried to see this companion with my feeble instrument of 46-lines aperture, I was able to perceive it at moments; I was, moreover, very much astonished to see that this companion was not alone, and that there were several other stars in the neighbourhood of *Sirius*, at distances varying from 15″ to 1′. The first (*c*) of these stars, or companions, is remarkable for its proximity to the central star; its position, approximately estimated, corresponds to an angle of 95°, reckoned from east to north. This new companion is sufficiently visible at moments, with the precautions necessary for such an observation; for all these minute stars, five in number, are immerged in the light of *Sirius*. The discovery was made with an object-glass of 46 lines; Mr. Clark employed an object-glass of 216 lines (18 inches). The difference of light was, therefore, as 1 to 22. The figure represents the six satellites (image reversed).

Position of the Satellites *b*, *c*, *d*, *e*, *f*, *g*, in regard to *Sirius* (*a*).



"These researches have been made independently of the remarkable theories of MM. Peters, Auwers, and Safford. Conversing with M. Radau, I was able to establish that there was a striking agreement between the data of M. Auwers and the observation of the Star No. 1 (*Ast. Nach.*, No. 1371)."

M. L'Abbé Moigno remarks that M. Goldschmidt remains faithful to the motto on the Medal of the Society, "*Quidquid nitet notandum.*"

* Translated and the woodcut extracted from No. 5 of *Les Mondes*, the weekly scientific journal edited, in place of the *Cosmos*, by M. L'Abbé Moigno.—Ed.

The following Errata in the *Monthly Notices*, together with some previously corrected, were communicated to the Editor by the Astronomer Royal.

Vol. XX, 1860.

Page 368, line 39, *for* α *Orionis, read* σ *Orionis.*

Vol. XXI., 1861.

Page 143, line 6, *for* outlines, *read* outliers.
— 196, — 12, *for* 1811, *read* 1861.
— 211, — 26, *for* third satellite, *read* first satellite.
— 244, — 15, *for* Best, *read* Birt.

Vol. XXII., 1862.

Page 278, line 8, *for* 18 inches, *read* 13 inches.
— 295, — 22, *for* ring of the shadow, *read* shadow of the ring.
— 322, — 14, *for* 161, *read* 164.

Vol. XXIII., 1863.

Page 70, line 12, *for* mere, *read* more.
— 75, last line but one, *for* their being, *read* with their being.
— 79, line 9, *for* 880°54, *read* 180°54.
— 92, — 26, *for* 133°6, *read* 183°6.
— 100, — 19, *for* place, *read* phase.
— 113, — 6, *for* P.E., *read* P.M.
— 120, — 14, *for* 65, *read* 98.
— 120, — 17, *for* 69, *read* 99.
— 120, — 24, *for* 117, *read* 116.

CONTENTS.

	Page
On the Fringes of Light observed by M. Poulain at Goree during the Total Eclipse, 31st December, 1861, by M. Goldschmidt ...	163
On the Determination of the Longitude of Valencia, in Ireland, by Galvanic Signals, in the Summer of 1862, by the Astronomer Royal	164
On the Movement of the Solar System in Space, deduced from the Proper Motions of 1167 Stars, by Mr. Dunkin (Abstract) ...	166
On the Rating of Chronometers, by Mr. Hartnup	170
On the Parallax of certain Stars, by M. Auwers	172
On the Parallax of the Fixed Stars, by M. Krüger	173
Results of the Meridional Observations of Small Planets, Occultation of a Star by the Moon; and Phenomena of *Jupiter's* Satellites; observed at the Royal Observatory, Greenwich, in the month of January, 1863	ib.
Occultations observed at Highbury, by Mr. Burr	175
On the Visibility of Stars in the Pleiades to the unarmed Eye, by the Astronomer Royal	ib.
Observations of *Mars*, by Mr. Lassell	176
Proceedings of the Madras Observatory, by Mr. Pogson	178
On the Spectra of some of the Fixed Stars, Mr. Huggins and Dr. Miller	179
Companions of *Sirius*, by M. Goldschmidt	181
Errata	182

Printed by STRANGEWAYS and WALDEN, Castle St, Leicester Sq. and Published at the Apartments of the Society, April 2, 1863.